

SECTION 16420

ENCLOSED CONTROLLERS

LANL MASTER CONSTRUCTION SPECIFICATION

When editing to suit Project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the LEM Electrical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within "stars" during editing.

Specification developed for ML-3 / ML-4 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. AC motor control devices rated 600V and less that are not an integral part of equipment or motor control centers.

Edit 1 through 3 to match Project requirements. Delete materials not applicable to Project.

1. Manual motor controllers for fractional horsepower motors.
2. Magnetic motor controllers, full-voltage, non-reversing.
3. Combination magnetic motor controllers, full-voltage, non-reversing.

1.2 SUBMITTALS

- A. Submit the following in accordance with Section 01330:
 1. Catalog data: Submit manufacturer's technical data for each type of motor controller and starter, including data proving that materials comply with specified requirements. Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
 2. Wiring diagram.
 3. Installation instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

4. Operation and maintenance instructions.

1.3 QUALITY ASSURANCE

- A. Comply with the *National Electrical Code* (NEC) for components and installation.
- B. Provide motor controllers and control stations listed and labeled by a nationally recognized testing laboratory (NRTL) as suitable for purposes specified and shown.

1.4 RECEIVING, STORING AND PROTECTING

- A. Receive, store, and protect, and handle products according to NECA 1—*Standard Practices for Good Workmanship in Electrical Construction*.

1.5 COORDINATION

- A. Coordinate the features of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, the duty cycle of the motor, drive, load, the pilot device, and control circuit affecting controller functions. Provide controllers that are horsepower rated to suit the motor controlled.

1.6 EXTRA MATERIALS

- A. Furnish one spare for every five installed fuses, but not less than one set of three of each kind.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Refer to Section 01630.

2.2 GENERAL

- A. Provide motor controllers having a UL 508 short circuit withstand rating that exceeds the fault current available at the controller line terminals.
- B. Provide enclosures in accordance with ANSI/NEMA ICS 6 - *Enclosures for Industrial Controls and Systems* with Type as required to meet conditions of installation.

2.3 FRACTIONAL HORSEPOWER MANUAL MOTOR CONTROLLERS

Edit Specification to match Project requirements. Delete if not required

- A. Provide general purpose, Class A, manually operated, full-voltage controller for AC fractional horsepower motors that conforms to the requirements of NEMA ICS 2 - *Industrial Control Devices, Controllers, and Assemblies*.

Edit B to match Project requirements.

- B. Provide starter with thermal overload unit, red pilot light, and [key] [toggle] operator.
- C. Provide handle guard with provision for locking in the OFF position.
- D. Manufacturer: Square D “Class 2510 Type F”.

2.4 MAGNETIC MOTOR CONTROLLERS - NON-REVERSING:

Edit Specification to match Project requirements. Delete if not required

- A. Provide general purpose, Class A, magnetic, full-voltage, non-reversing controllers for AC induction motors rated in horsepower that conforms to the requirements of NEMA ICS 2 - *Industrial Control Devices, Controllers, and Assemblies*.
- B. Provide products suitable for operation at an altitude of 7500 ft. above sea level.

Edit C to match Project requirements. Some special applications use 24V controls.

- C. Coil shall be of the encapsulated type. Coil operating voltage shall be [24] [120] volts, 60 Hz.
- D. Provide controllers of size and number of poles as indicated on the Drawings.
- E. Contacts shall be totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
- F. Wiring shall be “straight-through” with all terminals clearly marked.
- G. Provide solid-state overload units with the following characteristics for motors rated less than 100 full-load amperes:

Edit 1 to match Project requirements; some motor/load combinations require a Class 10 start time characteristic.

1. NEMA Class [10] [20] tripping characteristics.
2. Field selectable motor full load current.
3. Ambient temperature insensitive.
4. Phase loss protection.

5. Manual reset after time delay.

6. Integral current transformers.

Edit H to match Project requirements; delete if no motors on Project are rated from 100 to 300 full-load amperes. Refer to Section D5020 in the LANL Engineering Standards Manual for overload protection for motors rated over 300 full-load amperes.

H. Provide solid-state overload units with the following characteristics for motors rated from 100 to 300 full-load amperes:

Edit 1 to match Project requirements; some motor/load combinations require a Class 10 start time characteristic.

1. NEMA Class [10] [20] tripping characteristics.

2. Field selectable/adjustable overload trip current.

3. Phase unbalance and phase loss protection.

4. Manual or electric reset after time delay.

5. Current sensing using external current transformers with 5 amp secondary.

I. Provide not less than two sets of NEMA ICS 2 field convertible auxiliary contacts in addition to the seal-in contact.

J. Provide cover mounted, heavy duty, 22 mm or 30 mm, metal operator, oil tight pilot devices as listed below with NEMA ICS 2, Form Z, A600 rated contacts.

1. Selector Switches: Rotary type

- a. HAND-OFF-AUTO or ON-OFF-AUTO selector if controller is connected to automatic control system.
- b. Unless indicated otherwise on the Drawings, selector switch is not required if controller is not connected to automatic control system.

2. Push buttons:

- a. Flush, momentary-contact START pushbutton if controller is not connected to automatic control system.
- b. Flush, momentary-contact STOP pushbutton if controller is not connected to automatic control system.
- c. Unless indicated otherwise on the Drawings, START-STOP pushbuttons are not required if controller is connected to automatic control system.

Edit d to match Project requirements. Delete if not required

- d. Mushroom head, maintained action, turn-to-release or pull-to-release EMERGENCY STOP pushbutton as indicated on the Drawings.

3. Push-to-test LED type indicating lights:

- a. Red RUNNING pilot light.
- b. Green STOPPED pilot light.
- c. Additional pilot lights as indicated on the Drawings.

4. Provide legend plates for pushbuttons, pilot lights and selector switches.

- K. Provide externally operable manual reset operator.

Edit L to match Project requirements. Some special applications use 24V controls.

- L. Provide a control power transformer in each motor starter. The transformer shall have [24][120] volt secondary and sufficient capacity to operate starter coil and all connected pilot, indicating and control devices, plus 100 percent spare capacity. Provide fused primary and secondary. Bond un-fused leg of secondary to enclosure. Provide fuses or fuse holders with blown fuse indicators.

- M. Manufacturer: Square D "Class 8536 Type S".

2.5 CIRCUIT BREAKER TYPE COMBINATION MAGNETIC MOTOR CONTROLLERS - NON-REVERSING

Edit Specification to match Project requirements. Delete if not required

- A. Provide combination magnetic motor controllers with motor circuit protector disconnect and controller in a common enclosure.
- B. Provide products suitable for operation at an altitude of 7500 ft. above sea level.
- C. UL508 short circuit withstand rating shall be greater than the fault current available at the controller terminals.
- D. Motor circuit protector shall conform to UL 485 and NEMA AB 1 - *Molded Case Circuit Breakers*, with an integral instantaneous magnetic trip in each pole.

- 1. Trip units shall be calibrated to coordinate with the actual locked-rotor current of the connected motor and the controller overload relays.

2. Provide motor circuit protectors that are factory assembled with the controller, interlocked with unit cover or door, and arranged to disconnect the controller.
3. Motor circuit protector shall have a color coded externally operated handle. Operating handle shall give positive visual indication of ON- OFF with red and black color coding. Include provisions for padlocking handle in the OFF position.
4. Provide motor circuit protectors shall be rated 600 volts when used on 480 volt systems.

- E. Provide general purpose, Class A, magnetic, full-voltage, non-reversing controllers for AC induction motors rated in horsepower that conforms to the requirements of NEMA ICS 2 - *Industrial Control Devices, Controllers, and Assemblies*.

Edit E to match Project requirements. Some special applications use 24V controls.

- F. Coil shall be of the encapsulated type. Coil operating voltage shall be [24][120] volts, 60 Hz.
- G. Provide controllers of size and number of poles as indicated on the Drawings.
- H. Contacts shall be totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
- I. Wiring shall be "straight-through" with all terminals clearly marked.
- J. Provide solid-state overload units with the following characteristics for motors rated up to 100 full-load amperes:

Edit 1 to match Project requirements; some motor/load combinations require a Class 10 start time characteristic.

1. NEMA Class [10] [20] tripping characteristics
2. Field selectable motor full load current.
3. Ambient temperature insensitive.
4. Phase loss and phase unbalance protection.
5. Manual reset after time delay.
6. Integral current transformers.

Edit J to match Project requirements; delete if no motors on Project are rated from 100 to 300 full-load amperes. Refer to Section D5020 in the LANL Engineering Standards Manual for overload protection for motors rated over 300 full-load amperes.

- K. Provide solid-state overload units with the following characteristics for motors rated from 100 to 300 full-load amperes:

Edit 1 to match Project requirements; some motor/load combinations require a Class 10 start time characteristic.

1. NEMA Class [10] [20] tripping characteristics.
 2. Field selectable/adjustable overload trip current.
 3. Phase unbalance and phase loss protection.
 4. Manual or electric reset after time delay.
 5. Current sensing using external current transformers with 5 ampere secondary.
- L. Provide not less than two sets of NEMA ICS 2 field convertible auxiliary contacts in addition to the seal-in contact.
- M. Provide cover mounted, heavy duty, 22 mm or 30 mm, metal operator, oil tight pilot devices as listed below with NEMA ICS 2, Form Z, A600 rated contacts.
1. Selector Switches: Rotary type
 - a. HAND-OFF-AUTO or ON-OFF-AUTO if controller is connected to automatic control system.
 - b. Unless indicated otherwise on the Drawings, selector switch is not required if controller is connected to automatic control system.
 2. Push buttons:
 - a. Flush, momentary-contact START pushbutton if controller is not connected to automatic control system.
 - b. Flush, momentary-contact STOP pushbutton if controller is not connected to automatic control system.
 - c. Unless indicated otherwise on the Drawings, START-STOP pushbuttons are not required if controller is connected to automatic control system.

Edit d to match Project requirements. Delete if not required

- d. Mushroom head, maintained action, turn-to-release or pull-to-release EMERGENCY STOP pushbutton as indicated on the Drawings.

3. Push-to-test LED type indicating lights:

- a. Red RUNNING pilot light.
- b. Green STOPPED pilot light.
- c. Additional pilot lights as indicated on the Drawings.

4. Provide legend plates for pushbuttons, pilot lights and selector switches.

- N. Provide externally operable manual reset operator.

Edit N to match Project requirements. Some special applications use 24V controls.

- O. Provide a control power transformer in each motor starter. The transformer shall have [24][120] volt secondary and sufficient capacity to operate starter coil and all connected pilot, indicating and control devices, plus 100 percent spare capacity. Provide fused primary and secondary. Bond un-fused leg of secondary to enclosure. Provide fuses or fuse holders with blown fuse indication.
- P. Manufacturer: Square D "Class 8539 Type S".

PART 3 EXECUTION

3.1 EXISTING WORK

Delete this article when existing construction is not affected.

- A. Disconnect and remove abandoned enclosed motor controllers.
- B. Maintain access to existing enclosed motor controllers and other installations that are to remain active and to require access. Modify installation or provide access panel.
- C. Clean and repair existing enclosed motor controllers that are to remain or be reinstalled.

3.2 EXAMINATION

- A. Examine surfaces to receive control equipment for compliance with installation tolerances and other conditions affecting performance of the control system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install motor control equipment where indicated on the Drawings and according to manufacturer's instructions. Manufacturer's installation instructions shall be available at the construction site.

- B. Mount with operating mechanism 5'-0" above floor or as indicated on the Drawings.

Edit C, D, and E to match the current LANL standard specification numbers. Specifications are being updated in phases during 2003. The first section listed is the current number; the second is the intended future number.

- C. Install enclosed controllers plumb. Provide supports in accordance with the requirements of [Section 16190—ELECTRICAL SUPPORTING DEVICES] [Section 16070—HANGERS AND SUPPORTS] and the NEC.
- D. Ground and bond motor controllers and control devices as required in [Section 16450—SECONDARY GROUNDING] [Section 16060—GROUNDING AND BONDING].
- E. Identify motor controllers and install warning signs as required in [Section 16195—ELECTRICAL IDENTIFICATION] [Section 16075—ELECTRICAL IDENTIFICATION].
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not furnished, use those specified in UL 486A.
- G. Set overload relays or install overload heater elements in motor controllers to match installed motor characteristics.
- H. Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

3.4 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS. Perform inspections and tests listed in NETA ATS, Section 7.16.1. Correct any deficiencies before energizing controller.
- B. Verify that the proper overloads are installed and set for the motor nameplate full load current and duty.
- C. After completing installation, cleaning, and testing, touch up scratches and mars on finish to match original finish.

END OF SECTION

Do not delete the following reference information:

This project specification is based on LANL Construction Specification 16420, Rev. 0, dated March 24, 2003.